FORM PTO-1390 (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		WSP:204-US
		U.S. APPLN. NO. (IF KNOWN, SEE 37 CFR 1.5) 10/069636
INTERNATIONAL APPLN. NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/05522	15 June 2000	17 June 1999
TITLE OF INVENTION DISCHARGE VALVE FOR CO_2-PRESSURE CYLINDERS		
APPLICANT(S) FOR DO/EO/US KIEFER, Rainer		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☐ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.

4. ☐ The U.S. has been elected by the expiration of 19 months from the priority date (Article 31).

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☒ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (UNSIGNED)

10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☐ A FIRST preliminary amendment.

14. ☐ A SECOND or SUBSEQUENT preliminary amendment.

15. ☐ A substitute specification.

16. ☐ A change of power of attorney and/or address letter. (3 separate forms)

17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.

18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).

19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

20. ☒ Other items of information: **Certificate of Mailing with Express Mail Mailing Label No. EF155674296US**

U.S. APPLN NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLN. NO.	ATTORNEY'S DOCKET NUMBER
10/069636	PCT/EP00/05522	WSP:204-US

21. ☒ The following fees are submitted:

CALCULATIONS	PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492(a)(1) - (5):
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1 445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. **$1000.00**

International preliminary examination fee (37 CFR 1 482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO. **$710.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) . . . . . **$ 100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =				$ 860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	15 - 20 =	0	X $18.00	$ 0.00	
Independent claims	2 - 3 =	0	X $80.00	$ 0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	$ 0.00	
TOTAL OF ABOVE CALCULATIONS			=	$	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$	
SUBTOTAL			=	$ 860.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).			+	$	
TOTAL NATIONAL FEE			=	$ 860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property			+	$	
TOTAL FEES ENCLOSED			=	$ 860.00	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. in the amount of $ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 04-1790. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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DATED: February 26, 2002

SIGNATURE

MICHAEL L. DUNN
NAME

25,330
REGISTRATION NUMBER

		ATTORNEY'S DOCKET NUMBER WSP:204-US
		U.S. APPLN. NO. (IF KNOWN, SEE 37 CFR 1.5) 10/069,636
INTERNATIONAL APPLN. NO. PCT/EP00/05522	INTERNATIONAL FILING DATE 15 June 2000	PRIORITY DATE CLAIMED 17 June 1999
TITLE OF INVENTION DISCHARGE VALVE FOR CO_2-PRESSURE CYLINDERS		
APPLICANT(S) FOR DO/EO/US KIEFER, Rainer		

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Please amend the above-identified patent application as follows:

IN THE CLAIMS

Please cancel original Claims 1-19 and substitute the following new Claims 20-39:

20. A discharge valve for CO_2 pressure cylinders, comprising a flow passage (8) for CO_2 gas, a valve element (10) which is actuable from the exterior and which can assume various positions and which in at least one of said positions closes the flow passage and in at least one other of its positions opens the flow passage through a valve opening, and connecting means for fixedly and sealingly connecting the discharge valve to a CO_2 pressure cylinder, wherein a flow resistance is provided in the flow passage (8), which flow resistance is independent of the valve opening and wherein the flow resistance is such that at a temperature of 20°C and a CO_2 gas flow rate of 0.5 g/s it causes a pressure drop of at least 1 bar.

21. A discharge valve as set forth in Claim 20 wherein the pressure drop is more than 5 bars.

22. A discharge valve as set forth in Claim 21 wherein the pressure drop is a maximum of 50 bars.

23. A discharge valve as set forth in Claim 22 wherein the pressure drop is between 10 and 30 bars.

24. A discharge valve as set forth in Claim 20 wherein a check valve is provided that is independent of the discharge valve, said check valve, in an intake direction to fill a cylinder, opening a by-pass, by-passing the flow resistance and closing the by-pass in a discharge flow direction out of the cylinder.

25. A discharge valve as set forth in Claim 24 wherein the check valve is resiliently biased in a closed position.

26. A discharge valve as set forth in Claim 20 wherein the flow resistance is a sintered body or a pressure-resistant diaphragm.

27. A discharge valve as set forth in Claim 26 wherein the flow resistance at least partially comprises plastic material, ceramic or metal.

28. A discharge valve as set forth in Claim 26 in which the flow resistance comprises a sintered body having an average pore size in the range of between 1 and 10 μm.

29. A discharge valve as set forth in Claim 28 wherein the sintered body has a porosity of between 10 and 80%.

30. A discharge valve as set forth in Claim 28 wherein the sintered body has a porosity of between 10 and 40%.

31. A discharge valve as set forth in Claim 26 wherein the flow resistance is in the form of a valve body movably accommodated in a valve seat.

32. A discharge valve as set forth in Claim 31 wherein the flow resistance is biased in the CO_2 discharge flow direction.

33. A discharge valve as set forth in Claim 31 wherein the flow resistance has a substantially tapered surface for reception in the valve seat.

34. A discharge valve as set forth in Claim 20 wherein the valve element (10) is arranged on a side of the discharge valve which is remote from the CO_2 pressure cylinder, and wherein the flow resistance is arranged on a side of the discharge valve, which is towards the CO_2 pressure cylinder.

35. An attachment portion for attachment to a discharge valve for CO_2 pressure cylinders, wherein the attachment portion can be fixedly and sealingly connected to the discharge valve and has a flow resistance therein for causing a pressure drop of at least 1 bar from the pressure cylinder independently of the discharge valve.

36. The attachment portion of Claim 35 wherein the pressure drop is from 5 to 50 bars.

37. An attachment portion for a discharge valve as set forth in Claim 36 wherein the attachment portion has a male screwthread which corresponds to a female screwthread at an end of the discharge valve towards the CO_2 pressure cylinder.

38. An attachment portion as set forth in Claim 36 wherein a maximum outside diameter of the attachment portion is smaller than an inside diameter of a screwthread of the pressure cylinder.

39. An attachment portion as set forth in Claim 35 wherein on a side remote from the discharge valve the attachment portion has a female screwthread whose diameter and pitch correspond to a female screwthread at an end of the discharge valve body remote from the discharge valve.

Respectfully submitted,

Dated: July 30, 2002

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MLD/csc

Discharge valve for CO_2 pressure cylinders

The present invention concerns a discharge valve for CO_2 pressure cylinders, comprising a flow passage for CO_2 gas, a valve element which is actuable from the exterior and which can assume various positions and which in at least one of said positions closes the flow passage and in at least one other of said positions opens the flow passage, and connecting means for fixedly and sealingly connecting the discharge valve to a CO_2 pressure cylinder, wherein provided in the flow passage is a flow resistance which is independent of the valve opening which is openable by the valve element.

Corresponding discharge valves are known for example from US patents Nos 4 611 628 and 5 305 794. In US No 4 611 628 the additional flow resistance serves only as a switching aid for the valve, in which respect an intermediate pressure chamber which is disposed downstream of the flow resistance is initially emptied upon opening of the valve so that the valve body of which one end is in the intermediate pressure chamber is acted upon from its other end by the pressure of the pressure container and is thereby completely opened. In the case of US No 5 305 794, the arrangement has a valve connection which projects into a pressure container and which has two oppositely disposed bores which permanently provide a communication for an inner valve passage 70 to the interior of the pressure vessel. Those openings are of such dimensions that, even in the event of the outer valve portion breaking off, excessively large amounts of the gas contained in the container do not issue therefrom. At the same time, also provided on the valve connection which projects into the container is a check valve which opens a larger opening cross-section when the valve is acted upon from the outside by a pressure, in order for example to fill the container.

The above-indicated publications are however not concerned with the problem that the valve, instead of being acted upon by gas, could possibly also be acted upon by liquid, in which case the liquid which issues could

tend to involve very great expansion outside the cylinder or while still in the valve and could possibly also cause an explosion of external parts which are not as pressure-resistant as the pressure container.

Another known discharge valve is shown by way of example in Figure 1 of the accompanying drawings. In that case the discharge valve is a resiliently biased disk valve with an actuating nipple which projects at an end of the valve out of a recess. By pressing in the nipple, the valve disk is urged off its seat and thus opens a flow passage for CO_2 gas. In general terms the one end of such a discharge valve is fixedly screwed to a CO_2 pressure cylinder, in which case, by way of the screwthread, a collar which projects in a flange-like configuration, is pressed with an O-ring against the flat edge extending around the screwthreaded opening of a CO_2 pressure cylinder and thus connects the valve fixedly and sealingly to the CO_2 pressure cylinder. The other end is generally also screwed to an actuating device which also has a pressure-reducing device, in which respect parts on the pressure-reducing device are designed to actuate the actuating nipple of the discharge valve as soon as the pressure-reducing device is suitably set and CO_2 gas is to be taken from the pressure cylinder.

Furthermore, discharge valves of that kind generally also have an over-pressure safety valve which, upstream of the valve element which is actuable from the exterior, is connected to the flow passage of the discharge valve and which for example has a bursting disk which ruptures when a pressure limit value is attained in order to prevent the pressure gas bottle from exploding.

CO_2 pressure cylinders with corresponding discharge valves are in the meantime used relatively frequently for the production of what is known as soda water, that is to say drinking water to which carbon dioxide or CO_2 has been added. Increasing numbers of households have gone over to themselves producing corresponding drinking water with CO_2 added thereto, in colloquial speech also referred to as fizzy water or 'fizz', as that turns out to be considerably less expensive than buying bottled fizzy water as is generally commercially offered.

Special devices are provided for adding CO_2 to drinking water, for domestic use, in which devices on the one hand the CO_2 pressure cylinder is held and in which on the other hand a sufficiently pressure-resistant drinking water bottle can be accommodated, which can be connected in sealed relationship to the CO_2 pressure gas cylinder by way of the pressure-reducing device already mentioned above and corresponding feed conduits. As soon as a corresponding drinking water bottle has been fitted into or clamped in the device, a valve is actuated which, by way of the pressure-reducing device and the valve element of the discharge valve, provides the communication with the CO_2 pressure gas cylinder so that CO_2 gas flows into the bottle filled with drinking water, under a pressure which is typically in the range of between 2 and 10 bars, and in so doing is dissolved in the drinking water. After the drinking water has been subjected to the action of CO_2 gas under a suitable pressure for some seconds the valve is closed again and the drinking water bottle can be removed and thus the CO_2 gasified drinking water is ready for consumption. In general the drinking water bottle also has a closure in order to prevent rapid and premature degassing of the water.

So-called 'soda devices' of that kind are already in use in their millions and have proven their worth in principle. It has been found in practice however that the degree of gassing of the drinking water with CO_2 cannot always be kept at the same level, in spite of an identical period of actuation of the CO_2-gassing valve. In particular inclined positioning of a corresponding soda device or more or less inclined fitment to the wall can also have the result that it is not always the same amount of CO_2 that is dissolved in the drinking water, as when a corresponding soda device is positioned upright.

Furthermore it would frequently be desirable to store or mount the soda device in an inclined or recumbent position, in which case only the drinking water bottle would have to assume a substantially vertical position, upon being removed and fitted thereto. Pivotable connecting heads for corresponding drinking water bottles are already known. For reasons of space there would be a wish now and then in particular for the

CO_2 pressure gas cylinder to be also disposed in a fitment position other than the usual upright position, in or on the soda device. When a recumbent position is involved however, in the case of a filled CO_2 pressure gas cylinder, the CO_2 would firstly pass into the pressure-reducing device in liquid form, in which case it admittedly evaporates and in so doing cools down but then in the general case more CO_2 is dissolved in the drinking water than when the CO_2 passes into the pressure-reducing device only in gas form so that that situation can entail a greater degree of gasification of the water than the user wishes. Admittedly the filling valves can generally be so set that they possibly vent excess CO_2 to the exterior and the desired gasification pressure is generally also adjustable, but nonetheless letting out excess CO_2 is generally undesirable.

In addition, in the case of a recumbent CO_2 pressure gas cylinder, differing conditions would occur in the course of gradual emptying of the pressure gas cylinder as initially only liquid CO_2 passes out of the bottle and into the pressure-reducing device, after a certain time a mixture of liquid and gaseous CO_2 would issue and finally only gaseous CO_2 could issue when the level of liquid has fallen sufficiently. With the varying conditions therefore the user would always have to re-set the valves in order to maintain the respective gasification pressure and degree of gasification that he wanted and in that respect to allow as little excess CO_2 to escape as possible.

In comparison with that state of the art, the object of the present invention is to provide a discharge valve for CO_2 pressure gas cylinders, which ensures always constant filling conditions if possible in any installation positions of a CO_2 pressure gas cylinder, so that there is no longer any need to change desired valve settings once made by the user.

That object is attained in that the flow resistance is such that at a temperature of 20°C and a CO_2 gas flow rate of 0.5 g/s it causes a pressure drop of at least 1 bar, preferably of more than 3 bars.

It will be appreciated that the flow rate specified herein and the pressure drop relate to CO_2 in the gaseous condition.

It will also be appreciated that a valve with a more or less small or large valve passage opening affords a certain flow resistance, but in accordance with the invention there is to be provided an independent flow resistance which guarantees a greater pressure drop than is possible with the usual valve element of a discharge valve and thereby prevents the passage therethrough of liquid CO_2, at any event in relatively large amounts. Otherwise the nature of the configuration of the flow resistance is not subject to any limitations. It may involve an additional valve or pressure-reducing device, a plug with fine bores or other installation member, which only serves the purpose, by impeding a flow of liquid CO_2, of forcing it to convert into the gaseous condition before the CO_2 leaves the discharge valve.

A still more preferred embodiment is one in which such a flow resistance, under the specified conditions, causes a pressure drop of more than 5 bars and preferably more than 10 bars. On the other hand however the flow resistance should also be such that, with a CO_2 flow rate of 0.5 g/s and at a temperature of 20°C, it does not produce a pressure drop which is greater than 50 bars, and it is better if the pressure drop is less than 40 bars and particularly preferably less than 30 bars. An excessively high pressure drop at the specified flow rate would otherwise mean than normal filling of the drinking water bottle with CO_2 gas, to produce a suitable fizzy water, would take a relatively long time.

A most preferred embodiment of the invention is one in which, under the specified conditions, the flow resistance produces a pressure drop of between about 12 and 15 bars.

By virtue of the high flow resistance and due to the pressure drop which is related thereto at a corresponding flow rate, liquid CO_2 goes into the gaseous condition on flowing through the flow resistance so that it is practically impossible for the CO_2 to pass through the flow resistance in liquid form.

In other words, even if the CO_2 pressure gas cylinder is turned upside down and in that situation the discharge valve is actuated, the flow resistance nonetheless provides that the CO_2 can pass through or issue

from the flow resistance only in gaseous form, thereby ensuring that CO_2 cannot pass into and through the pressure-reducing device in liquid form.

This ensures the desired constancy of the amount of CO_2 dissolved in the drinking water, under very different external operating conditions and when the CO_2 pressure cylinder is in any installation position.

Desirably, in addition to the flow valve, there is a check valve which in the intake direction opens a by-pass which by-passes the flow resistance but closes it in the discharge direction. As the corresponding pressure gas cylinders are generally also filled by way of the discharge valve, more specifically under a relatively high pressure of about 90 bars, using CO_2 in liquid form, the above-mentioned flow resistance in the discharge valve would be a severe impediment and would prolong the filling times of the CO_2 pressure gas cylinders by a multiple. By virtue of the fact that the arrangement has a check valve which opens in that filling direction and which permits the flow resistance to be by-passed, the filling operation is not impeded.

Desirably the check valve in question is resiliently biased in the closing direction.

The flow body can be for example a sintered body, but it is equally possible also to use a pressure-resistant diaphragm.

In the preferred embodiment the flow resistance is made from plastic material or ceramic material, for example in the form of a porous sintered body. Equally however the flow resistance could also be made from a metallic sintered body.

The preferred average pore size of such a sintered body or other porous material should preferably be of the order of magnitude of between 1 and 10 μm, in which respect the porosity can be between 10% and 80%.

In an embodiment of the discharge valve according to the invention the flow resistance in the form of a porous sintered body can be a valve body which is accommodated movably in a valve seat. This 'valve' formed by a sintered body or other porous or partially permeable element would admittedly not be sealed in the closed condition but in the closed condition would still allow the passage therethrough of the quantities which can pass

through the flow body which here is in the form of a valve body, but at the same time that valve body can be moved out of its seat and thus (in the intake direction) would open a considerably larger flow cross-section whose flow resistance would be negligible. In that case therefore the flow resistance itself would form a part of a check valve. It will be appreciated that, in this case, the flow resistance which is in the form of a valve body should be biased resiliently against a valve seat in the discharge direction so that, when the valve body is acted upon from the outside, more specifically upon filling the CO_2 pressure cylinder, the flow resistance is urged out of its valve seat and thereby opens the by-pass for by-passing the flow resistance. Desirably, the valve body is in the form of a flow resistance with a tapered end which comes into engagement with the valve seat.

A particularly preferred embodiment of the invention is one in which the flow resistance is provided in an attachment portion which can be connected to the actual discharge valve. For example that attachment portion can be provided at one end with a male screwthread in the manner of a screw and is then screwed, in place of a closure screw, into the lower end of such a discharge valve, in which case such a conventional closure screw is generally screwed into the lower end of a through opening in the discharge valve and serves as a support for a valve spring which is arranged in that passage or flow duct and which biases the actuating valve of the discharge valve in the discharge flow direction. It will be appreciated that such a closure or support screw has a bore therethrough for CO_2 to pass substantially unimpededly therethrough and the attachment portion can equally also be bored therethrough and can have the above-mentioned flow resistance in that through bore.

In that respect however it may be necessary, possibly from the interior of the pressure cylinder, to make a separate communication with a bursting disk, or to provide the flow resistance only beyond a branch duct to the bursting disk in the discharge valve. It will be appreciated in that respect that it is desirable if the overall diameter of the attachment portion is smaller than the inside diameter of the screwthread of the opening in the

pressure cylinder, into which the discharge valve is screwed. In that way it is very easily possible for conventional discharge valves to be equipped with the additional component according to the invention, insofar as the bored closure screw is simply replaced by the attachment portion according to the invention, which on the one hand functions as a closure screw and forms a support for the valve spring which is provided in any case in the discharge valve, but at the same time it also includes the flow resistance which substantially prevents CO_2 from passing through in liquid form or so severely limits it in terms of quantity that on the side of the pressure-reducing device, there are practically always equivalent operating conditions prevailing, which without avoidable CO_2 losses result in a uniform degree of gasification of the fizzy water.

The present invention is directed in that respect also to the attachment portion which is to be sold separately from the discharge valve and which can be connected to a discharge valve and which includes a corresponding flow resistance.

Further advantages, features and possible uses of the present invention will be clearly apparent from the description hereinafter of a preferred embodiment and the accompanying Figures in which:

Figure 1 shows a discharge valve in accordance with the state of the art,

Figure 2 shows a first embodiment of a supplemented flow valve according to the invention with a flow resistance and a check valve additionally provided therein,

Figure 3 shows a further embodiment with a flow resistance in the form of a valve body,

Figure 4 shows an embodiment similar to Figure 3, but in which the valve body additionally has better guide means, and

Figure 5 shows a view in section taken along line V-V in Figure 4, in which it is possible to see the cross-section of the guide portion of the valve body.

Referring to Figure 1, the discharge valve 100 which is known from the state of the art comprises a valve body 1 with a flow passage 8 and an

actuating valve 10. The actuating valve 10 in turn comprises the valve disk 2, the actuating nipple 3 connected thereto, the guide portion 4 of the valve element, a valve spring 9 and a support screw 7. The support screw 7 has a bore therethrough and provides a flow passage 11 which communicates with the main flow passage 8. The guide portion 4 has either clearance, longitudinal grooves or bores, which ensure that the flow passage 8 opens a corresponding discharge cross-section for the CO_2 gas when the actuating nipple 3 is pressed in and the valve disk 2 is disengaged from its seat. The lower portion of the valve body 1 has a male screwthread 6 which is screwed into a corresponding female screwthread in the opening of a pressure gas bottle or cylinder. In that situation an O-ring 5 comes into engagement with a flat edge which extends around the opening of the pressure gas cylinder and is pressed firmly and sealingly on to that edge by a collar 12 provided on the valve body 1 above the O-ring 5. An over-pressure valve 20 is additionally in communication with the flow passage 8 and, when a corresponding over-pressure occurs, opens a vent opening in order to prevent the pressure gas cylinder from exploding.

Figure 2 shows a first embodiment of a discharge valve 200 modified in accordance with the invention, in which respect the modification is essentially that the support or closure screw 7 has been replaced at the lower end of the valve by an attachment portion 30 which has an attachment body 34 in which there is accommodated a porous sintered body 31 having a central bore with a check valve provided therein. The check valve 15, 16, 17 is biased in the discharge flow direction by means of a spring 17 and communicates with a corresponding valve seat within the sintered body 31. When pressure is applied from the side of the pressure gas cylinder that check valve 15, 16, 17 is closed so that CO_2 can only pass through the porous sintered body 31 in the flow passage 8 when the valve element 10 is actuated.

In the embodiment shown in Figure 3, the closure screw 7 of the valve 100 is also replaced by an attachment portion 30'. In this case a partially permeable check valve is formed by the body 34' of the attachment portion 30' and a sintered body 32 which is accommodated

therein and which is of a tapered configuration in the upper part. The sintered body 32 is biased by a spring in the discharge flow direction against a tapered valve seat provided in the attachment body 34', with the spring being supported against a support screw 7' having a through bore 11', similarly to the support screw 7 of the valve in the state of the art. In the discharge flow direction, the CO_2 has to pass through the sintered body 32 and can pass into a pressure-reducing device by way of the passage 11', 8 and the valve element 10.

In contrast, in the intake direction, the pressure of the inflowing CO_2 gas or the CO_2 in liquid form provides that the porous sintered body 32 is urged away from its valve seat so that the CO_2 can flow into the pressure gas cylinder past the sintered body 32.

The embodiment shown in Figure 4 is very similar to that shown in Figure 3, except that in this case the lower portion of the porous sintered body 33 is of a substantially cylindrical configuration, of an outside diameter which substantially corresponds to the inside diameter of the body 34" in its lower part, so that as a result the porous sintered body 33 has good guidance and cannot tilt. For the purposes of allowing the CO_2 gas or the CO_2 in liquid form to pass therethrough in the operation of filling a pressure gas cylinder, provided in the cylindrical guide portion of the sintered body 33 are grooves 35 extending in the longitudinal direction so that, when the sintered body 33 is pushed back against the spring 9' in the operation of filling the pressure cylinder and as a result a passage is opened between the tapered valve seat and the tapered portion of the sintered body, the CO_2 can also flow into the pressure gas cylinder, past the cylindrical portion, through the longitudinally extending grooves 35.

The cross-section of that cylindrical portion with the two grooves 35 can be clearly seen in Figure 5.

CLAIMS

1. A discharge valve for CO_2 pressure cylinders, comprising a flow passage (8) for CO_2 gas, a valve element (10) which is actuable from the exterior and which can assume various positions and which in at least one of said positions closes the flow passage (8) and in at least one other of its positions opens the flow passage (8), and connecting means (6, 5) for fixedly and sealingly connecting the discharge valve (100) to a CO_2 pressure cylinder, wherein provided in the flow passage (8) is a flow resistance (31, 32, 33) which is independent of the valve opening which is openable by the valve element (10), characterised in that the flow resistance (31, 32, 33) is such that at a temperature of 20°C and a CO_2 gas flow rate of 0.5 g/s it causes a pressure drop of at least 1 bar and preferably of more than 3 bars.

2. A discharge valve as set forth in claim 1 characterised in that the pressure drop is more than 5 bars and preferably more than 10 bars under the specified conditions.

3. A discharge valve as set forth in claim 1 or claim 2 characterised in that the pressure drop is at most 50 bars, preferably less than 40 bars and particularly preferably less than 30 bars.

4. A discharge valve as set forth in one of claims 1 through 3 characterised in that the pressure drop caused under the conditions recited in claim 2 at the flow resistance is between 12 and 15 bars.

5. A discharge valve as set forth in one of claims 1 through 4 characterised in that it has a check valve (15, 16, 17) which is independent of the discharge valve (10) to be actuated and which in the intake direction opens a by-pass (35) by-passing the flow resistance (31) and closes in the discharge flow direction.

6. A discharge valve as set forth in claim 5 characterised in that the check valve is resiliently biased in the closing direction.

7. A discharge valve as set forth in one of claims 1 through 6 characterised in that the flow resistance is a sintered body (31, 32, 33) or a pressure-resistant diaphragm.

8. A discharge valve as set forth in claim 7 characterised in that the flow resistance at least partially comprises plastic material or ceramic.

9. A discharge valve as set forth in claim 7 characterised in that the flow resistance comprises metal.

10. A discharge valve as set forth in one of claims 7 through 9 in which the flow resistance comprises a sintered body characterised in that the sintered body has an average pore size in the range of between 1 and 10 μm.

11. A discharge valve as set forth in claim 10 characterised in that it is of a porosity of between 10 and 80%, preferably between 10 and 40%.

12. A discharge valve as set forth in one of claims 1 through 11 characterised in that the flow resistance (32, 33) is in the form of a valve body movably accommodated in a valve seat (36).

13. A discharge valve as set forth in claim 12 characterised in that the flow resistance (32, 33) is biased in the CO_2 discharge flow direction.

14. A discharge valve as set forth in one of claims 12 and 13 characterised in that the flow resistance (32, 33) has a substantially tapered surface for reception in a valve seat (36).

15. A discharge valve as set forth in one of claims 1 through 14 wherein the valve element (10) is arranged on a side of the discharge valve which is remote from the CO_2 pressure cylinder, characterised in that the flow resistance is arranged on the side of the discharge valve, which is towards the CO_2 pressure cylinder.

16. An attachment portion for a discharge valve for CO_2 pressure cylinders, characterised in that the attachment portion (30, 30', 30") can be fixedly and sealingly connected to the discharge valve and has a flow resistance (31, 32, 33) as set forth in one of claims 1 through 16.

17. An attachment portion for a discharge valve as set forth in claim 16 wherein at its end towards the CO_2 pressure cylinder the discharge valve has a female screwthread for receiving a support spring (9) for the valve element (10), characterised in that the flow resistance (31, 32, 33) is arranged in an attachment portion with a male screwthread which corresponds to the female screwthread at the inner end of the discharge valve (100).

18. An attachment portion as set forth in claim 16 or claim 17 characterised in that the maximum outside diameter of the attachment portion (34, 34', 34") is smaller than the inside diameter of a receiving screwthread of the pressure cylinder for connection to the discharge valve.

19. An attachment portion as set forth in one of claims 16 through 18 characterised in that on its side remote from the discharge valve the attachment portion (34, 34', 34") has a female screwthread whose diameter and pitch correspond to the female screwthread at the inner end of the discharge valve body.

Abstract

Discharge valve for CO_2 pressure cylinders

The present invention concerns a discharge valve for CO_2 pressure cylinders, comprising a flow passage (8) for CO_2 gas, a valve element (10) which is actuable from the exterior and which can assume various positions and which in at least one of said positions closes the flow passage (8) and in at least one other of its positions opens the flow passage (8), and connecting means (6, 5) for fixedly and sealingly connecting the discharge valve (100) to a CO_2 pressure cylinder. In order to provide a discharge valve for CO_2 pressure gas cylinders which ensures always constant filling conditions if possible in any installation positions of a CO_2 pressure gas cylinder so that desired valve settings once made by the user no longer need to be altered, it is proposed in accordance with the invention that provided in the flow passage (8) is a flow resistance (31, 32, 33) which is independent of the valve opening which can be opened by the valve element (10).

Figure 3

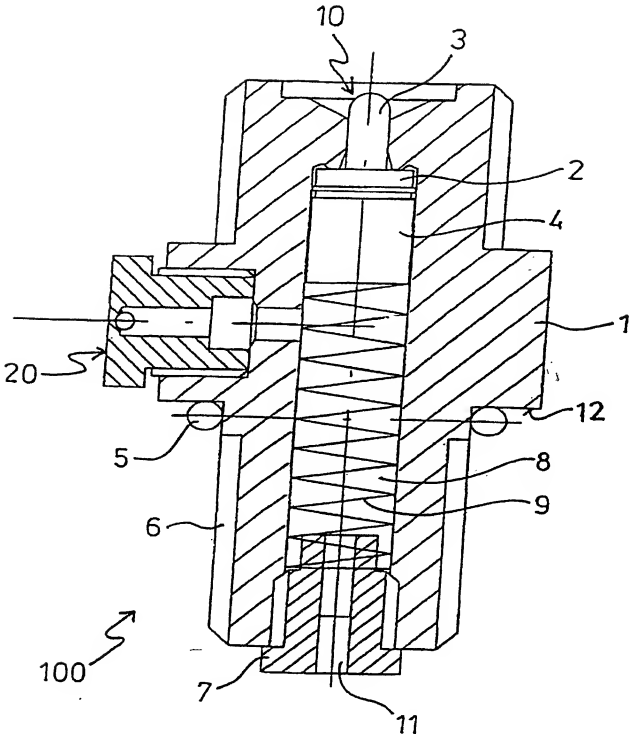

Fig. 1

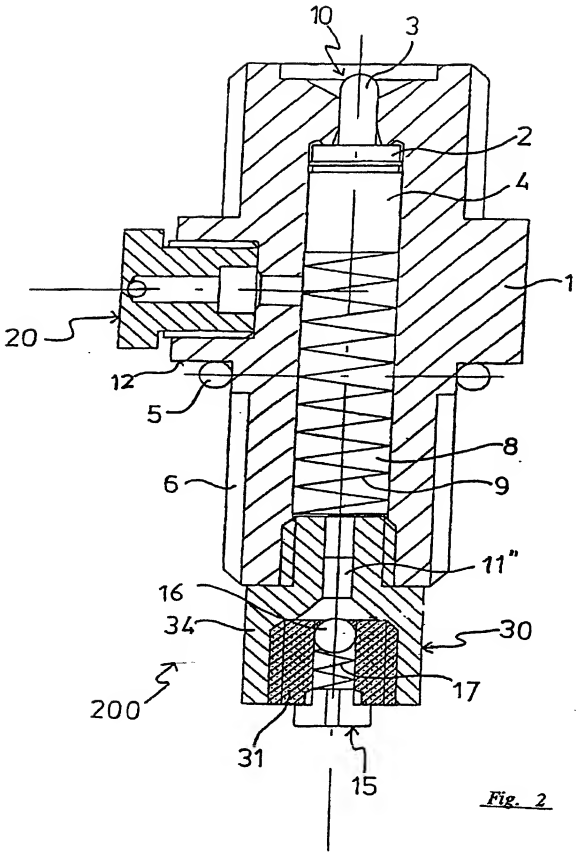

Fig. 2

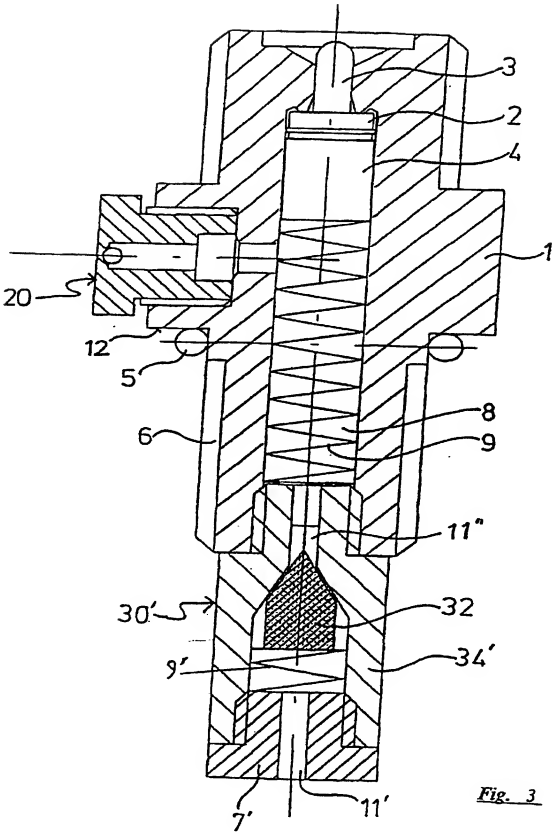

Fig. 3

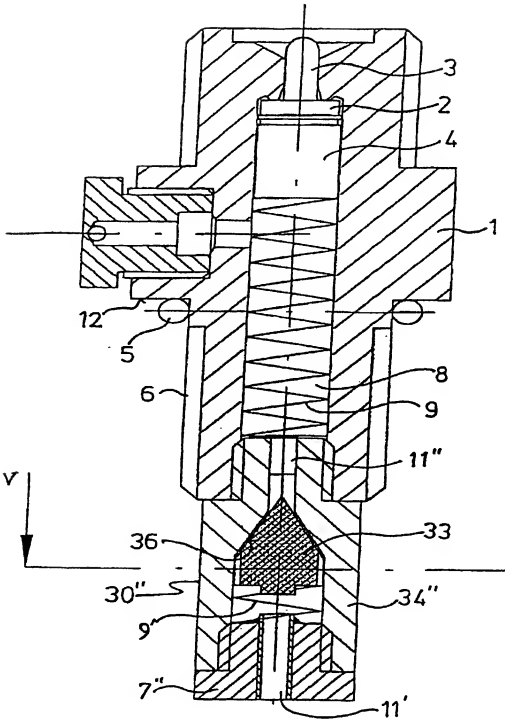

Fig. 4

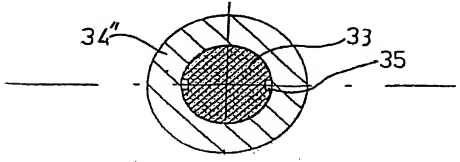

Fig. 5

PTO/SB/01 (10-01)
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted with Initial Filing

OR

☑ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	WSP:204 US
First Named Inventor	Rainer Kiefer
COMPLETE IF KNOWN	
Application Number	10/069,636
Filing Date	
Art Unit	
Examiner Name	

As the below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DISCHARGE VALVE FOR CO2-PRESSURE CYLINDERS

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☑ was filed on (MM/DD/YYYY) 06/15/2000 as United States Application Number or PCT International Application Number PCT/EP00/05522 and was amended on (MM/DD/YYYY) 05/25/2001 (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
199 27 667.6	Germany	06/17/1999	☐	☐	☑
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

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DECLARATION — Utility or Design Patent Application

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR : ☐ A petition has been filed for this unsigned inventor

1.00

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Inventor's Signature		Date
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Residence: City	**State**	**Country**	**Citizenship**
Mailing Address			
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☐ Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

10/069636
PCT/PTO 05 AUG 2002

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Application Number	10/069,636
Filing Date	Not yet assigned
First Named Inventor	Rainer Kiefer
Title	Discharge Valve for CO_2-Pressure Cylinders
Group Art Unit	Not yet assigned
Examiner Name	Not yet Assigned
Attorney Docket Number	WSP:204 US

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☒ Applicant/Inventor.

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

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Signature	Rainer Kiefer
Date	22.06.02

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of [ ] forms are submitted.